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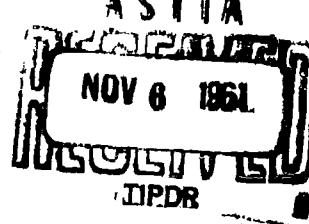
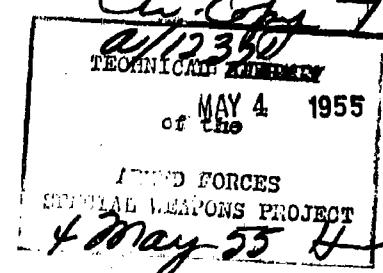
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TECHNICAL NOTE No. 950

AFSWP No. 771



## A Rugged Blast-Sensitive Switch

WILLIAM C. STANGE

XEROX  
62-1-4

DEPARTMENT OF THE ARMY PROJECT No. 503-04-002  
ORDNANCE RESEARCH AND DEVELOPMENT PROJECT No. TB3-0112J

BALLISTIC RESEARCH LABORATORIES



ABERDEEN PROVING GROUND, MARYLAND

BALLISTIC RESEARCH LABORATORIES

TECHNICAL NOTE NO. 950

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October 1954

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ABERDEEN PROVING GROUND, MARYLAND

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TECHNICAL NOTE NO. 950

WCStange/pg  
Aberdeen Proving Ground, Md.  
October 1954

A RUGGED BLAST-SENSITIVE SWITCH

ABSTRACT

The design and construction of a rugged, weatherproof, blast-sensitive switch which has been tested at BRL are described in detail. A diaphragm is used in conjunction with a small switch producing a unit which is sensitive to shock pressure as low as 0.7 psi.

## INTRODUCTION

The Corps of Engineers desired that a rugged, blast-sensitive switch be designed to operate closure devices for air intake and exhaust openings in protective structures.

The following requirements were requested and accordingly, were incorporated into the design of the trigger unit which was developed.

1. Weatherproof
  - a. Corrosion resistant
  - b. Sun, rain, wind and snow-proof
  - c. Wide temperature working range
2. Long life without adjustment
3. Simple construction
  - a. Readily mounted
  - b. Easily assembled and adjusted
4. Rugged
5. Sensitive to 2 lbs/in<sup>2</sup> blast pressure or less
6. Relatively tamperproof

## DESIGN AND CONSTRUCTION OF TRIGGER UNIT

In the design of the trigger unit, simplicity has been stressed so that the unit can be assembled by anyone familiar with its operation. The unit consists essentially of three sections: the body assembly, the diaphragm, and the switch. Drawings 1 - 9 are attached, which show in detail the trigger unit assembly and its various parts.

A pin plunger type miniature microswitch was used because of its small size, 7 ounce operating force, 0.030 inch pretravel, 1 ounce release force, 0.010 inch contact break distance, and overall rugged construction.

The design problem was essentially to mount a diaphragm exposed to the atmosphere so that it could be adjusted to bear against the switch and to encase this working element in a protective body. For reasons of simplicity and water-tightness the wires to the switch were conveyed through the body (see Drawing 2) and around the diaphragm assembly (Draw-

ings 5, 6 and 7). The diaphragm assembly screws into the body bringing the diaphragm to bear upon the switch. By adjusting the position of the diaphragm assembly a wide range of sensitivity may be obtained. A small spanner wrench is used to emplace the diaphragm assembly and also to adjust the sensitivity of the unit.

A large nut (Drawing 3) is used to hold the body (Drawing 2) rigidly to the mount (Drawing 4). The mount is threaded on to a convenient pipe support when used in the field. The diaphragm is ported to the atmosphere by means of a concentric ring of 1/2 inch holes in the body (Drawing 2).

Through the liberal use of aluminum an easily machinable and weatherproof trigger unit was designed. Tests have shown that weather-proofing was improved by applying rubber cement to the threads of the diaphragm assembly after it was properly adjusted for sensitivity. Further simplification and compactness could probably be obtained if quantity manufacture were contemplated.

#### RESULTS OF TEST

The trigger unit was assembled using a 0.005 inch thick brass diaphragm and mounted one foot from the end of the 2½ inch Ballistic Research Laboratories Shock Tube. The following results were obtained with the apparatus as described.

<u>SHOT NUMBER</u>	<u>SWITCH CLOSURE</u>	<u>SHOCK PRESSURE AT TRIGGER UNIT</u>
1	Yes	1.4 PSI
2	Yes	0.7
3	Yes	7.3
4	Yes	10.3
5	No	0.8

Switch closure was obtained on all shots except for shot number 5. Failure of shot 5 was undoubtably due to a small indentation in the diaphragm caused by shot 4 deforming the diaphragm around the switch plunger. Since successful repetitive operation is not a requirement, this failure was not considered serious.

Further shock tests have been made at intervals for a period of seven months during which time the unit was exposed to the weather. Positive operation of the switch occurred in every test with no failures.

The switch design is therefore considered adequate for the use  
for which it was intended.

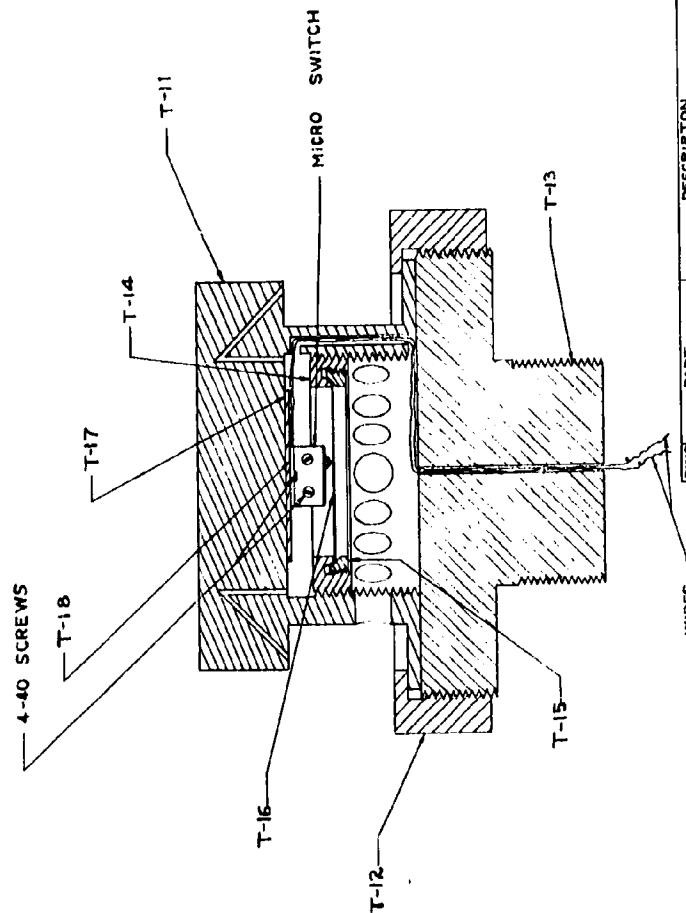
William C. Stange  
Wm C. Stange

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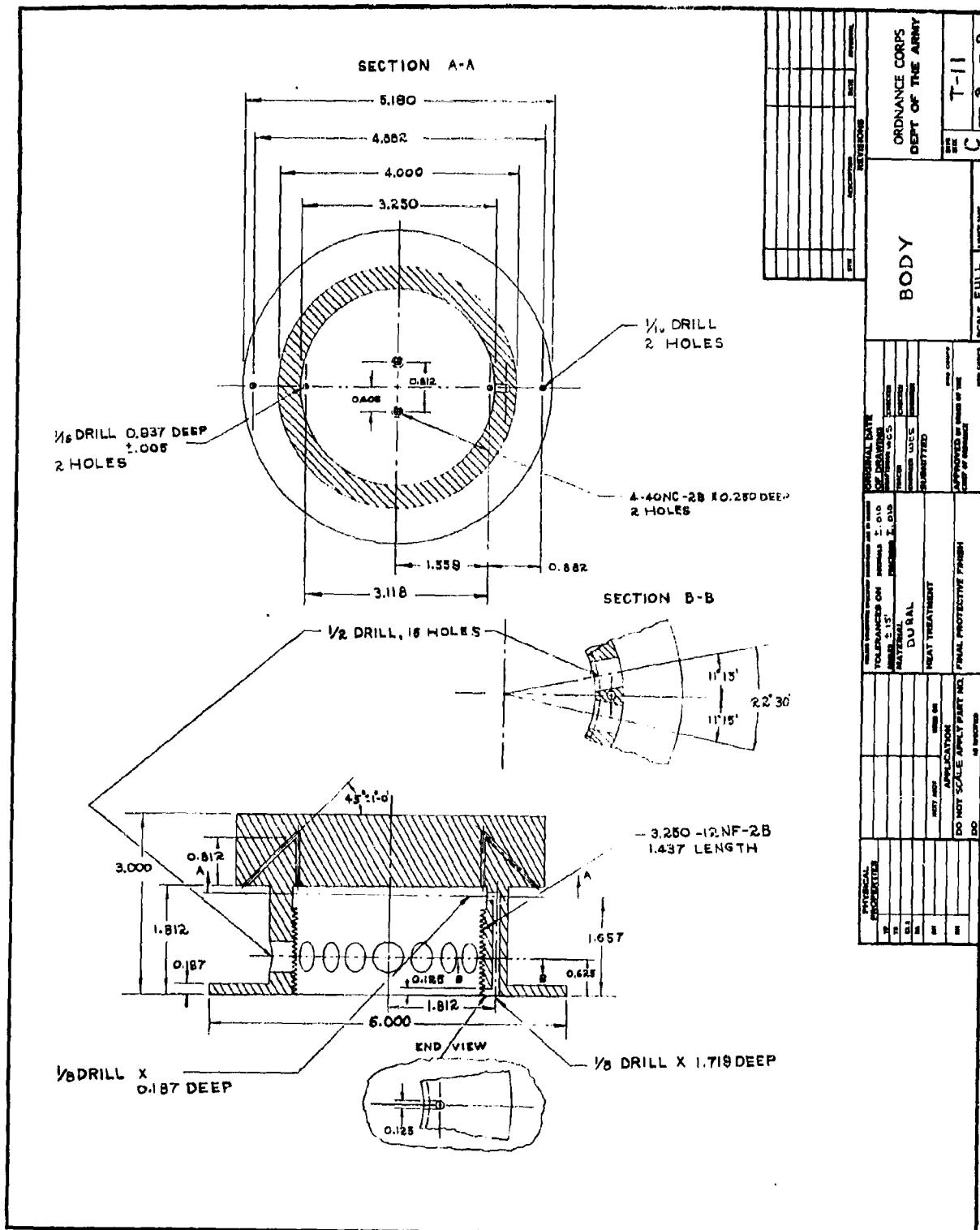
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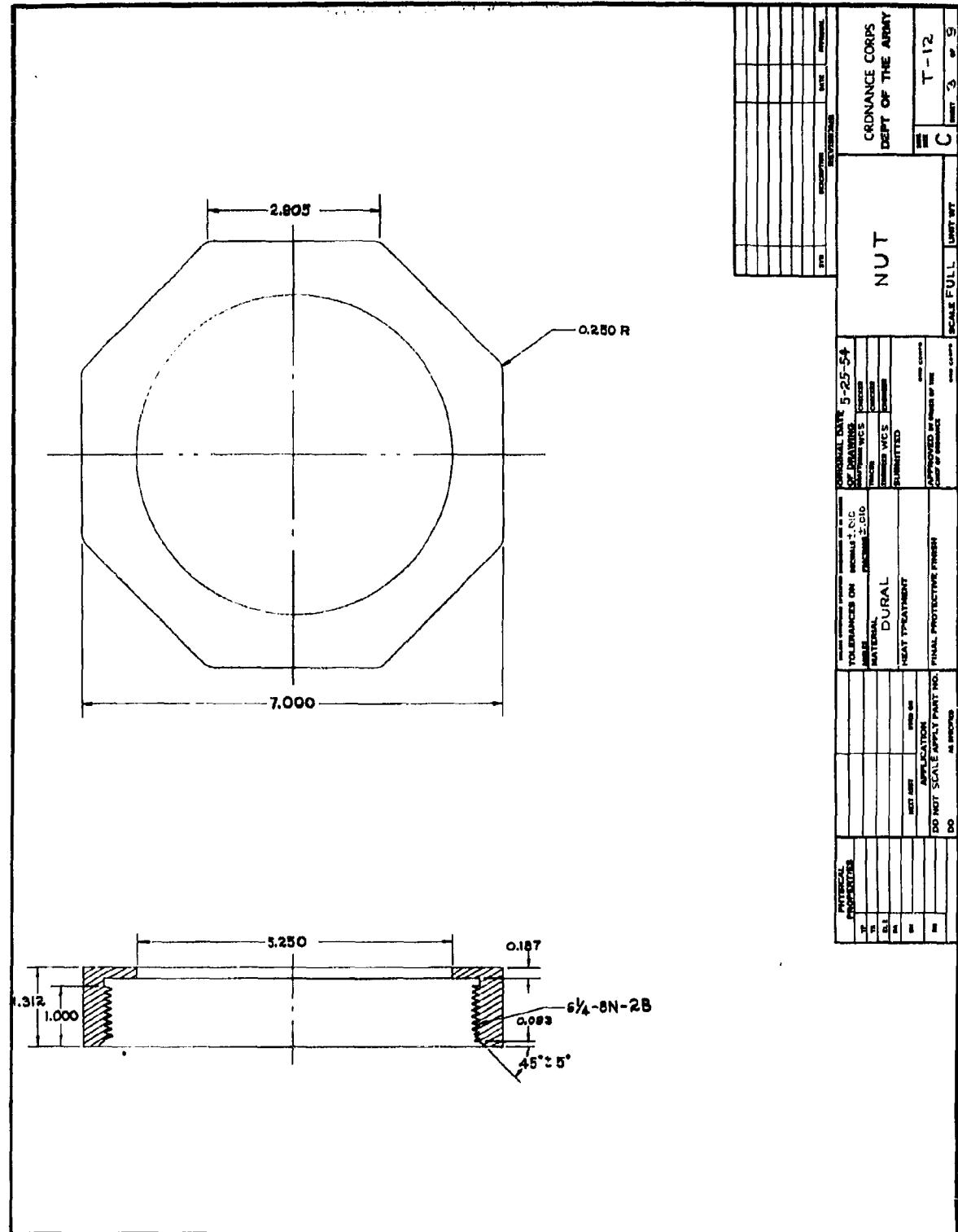
Pressure Sensitive Switching Device.



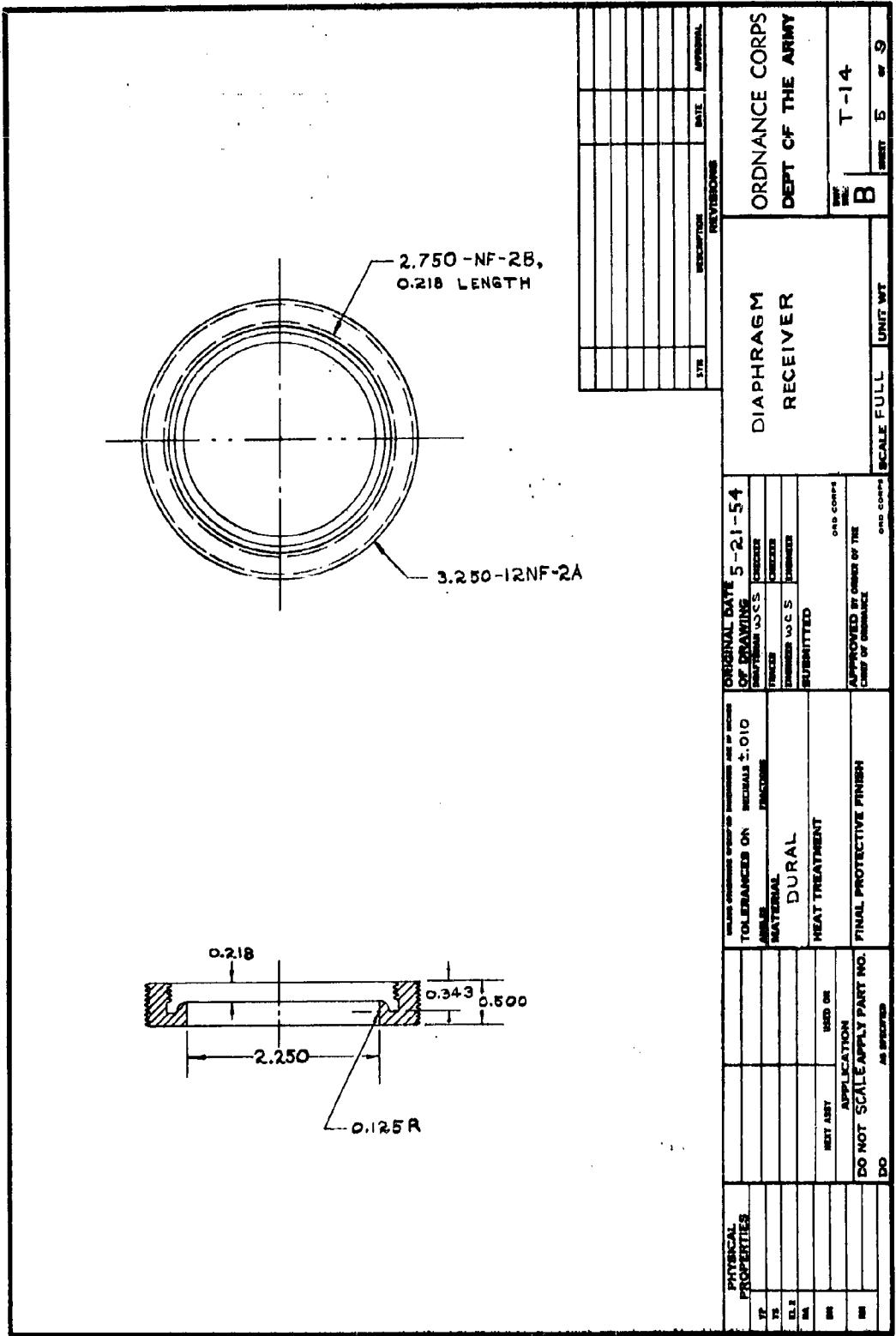


DWS PART	DESCRIPTION	REVISIONS		DATE REVISED	INVENTOR
		REV.	DESCRIPTION		
T-11 BODY					
T-12 MOUNT					
T-13 DIAPHRAGM RECEIVER					
T-14 DIAPHRAGM HOLDER					
T-15 DIAPHRAGM HOLE					
T-16 DIAPHRAGM					
T-17 INSULATOR					
T-18 SUPPORT					
SURENS NO. 4-40	TWO OF 2.005 LONG				
NUT'S NO. 4-40	HEX HEAD, TWO REQUIRED				
MICRO SWITCH	PIN PLUNGER, 15M				
WIRE					
CHART DATE 6-8-54					
CHART NUMBER 6-8-54					
CHART DRAWN BY C. J. COOPER					
CHART APPROVED BY C. J. COOPER					
TOLERANCES ON NORMAL					
MATERIAL					
HEAT TREATMENT					
APPROVED BY MEMBER OF THE					
FINAL PROTECTIVE FINISH					
APPLY TO PART NO. C					
C					
T-10					
C					
SCALE FULL					
INCH WT					

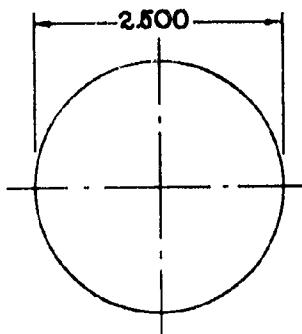






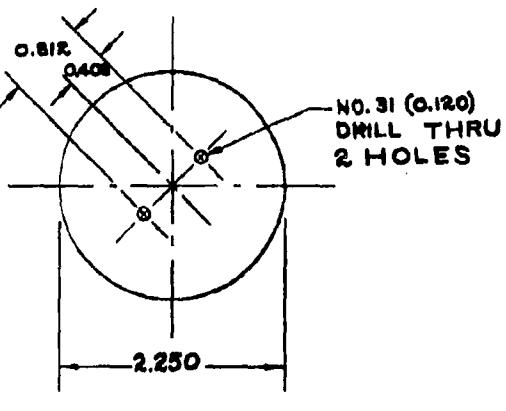






A technical drawing showing a cross-hatched area. A dimension line with arrows at both ends spans the width of the hatched area, with the text "0.005 THICK" written above it.

APPROVAL		DATE	
REVISIONS		REVISION	
SYN		SYN	
ORDNANCE CORPS DEPT OF THE ARMY			
DRAWING DATE 5-25-54 OF DRAWING 1-00 MATERIAL 5% ALUMINUM BRONZE TOLERANCES ON INCHES ± .010 TEST AND APPLICATION		DIAPHRAGM SUBMITTED HEAT TREATMENT FINAL PROTECTIVE FINISH DO NOT SCALE APPLI PART NO. 100	
PHYSICAL PROPERTIES		APPROVED BY CHIEF OF THE ORD CORPS	
TENSILE STRENGTH IN LBS. PER SQ. IN.		UNIT WT.	
EL. 2		SCALE FULL.	
IN		ORD CORPS	
IN		T-16	
IN		SYN 7 9	



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